

- 1 1. A method of fabrication of etching a low -k dielectric  
2 layer used in microelectronics fabrication; comprising the  
3 steps of :
- 4 a) forming an organic low k dielectric layer over a  
5 substrate;
- 6 b) forming a masking pattern over said organic low k  
7 dielectric layer; said masking pattern having an  
8 opening;
- 9 c) using an etch process said organic low k dielectric  
10 layer through said opening using said resist pattern as  
11 an etch mask; said etch process comprising:
- 12 (1) in a first step, etching said organic low k  
13 dielectric layer by applying a plasma power and  
14 flowing at least  $\text{NH}_3$  gas.
- 1 2. The method of claim 1 wherein said first step comprises  
2 applying a medium plasma power plasma density  
3 between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$  and flowing only  $\text{NH}_3$  gas.  
4
- 5 3. The method of claim 1 wherein said first step comprises  
6 applying a medium plasma power plasma density  
7 between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$  and flowing only  $\text{NH}_3$  gas, a power in  
8 between 500 and 1500 W, and a  $\text{NH}_3$  flow between 50 and 300 sccm  
9 and a pressure between 80 and 800 mTorr.
- 10 4. The method of claim 1 wherein said first step comprises  
11 applying a medium plasma power plasma density  
12 between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$  and flowing only  $\text{NH}_3$  gas, a power in  
13 between 500 and 1500 W, and a  $\text{NH}_3$  flow between 50 and 300 sccm  
14 and a pressure between 80 and 800 mTorr and flowing CO or  $\text{O}_2$   
15 gasses.

- 16 5. The method of claim 1 wherein said organic low k dielectric  
17 is comprised of a material selected from the group consisting  
18 of fluorinated arylether, Benzocyclobuthene (BCB), amorphous  
19 teflon, carbon doped oxides, poly arylene ether (PAE) and  
20 organic Spin on materials.
- 21 6. The method of claim 1 wherein said organic low k dielectric  
22 is comprised of a material selected from the group consisting  
23 of fluorinated arylether, and poly arylene ether.
- 24 7. The method of claim 1 wherein said organic low k dielectric  
25 is comprised of carbon doped oxide.
- 26 8. The method of claim 1 wherein said organic low k dielectric  
27 is comprised of poly arylene ether (PAE).
- 28 9. The method of claim 1 wherein said etch forms a first  
29 opening through said organic low k dielectric layer; said  
30 first opening having sidewalls defined by said organic low k  
31 dielectric layer; said sidewalls are substantially vertical at  
32 a angle between 87 and 93 degrees to the surface of the  
33 substrate.
- 34 10. The method of Claim 1 wherein the substrate is selected  
35 from the group consisting of: microelectronics conductor  
36 materials; microelectronics semiconductor materials; and  
37 microelectronics dielectric materials.
- 38
- 1 11. A method of fabrication of etching a low -k dielectric  
2 layer, comprising the steps of :
- 3 a) forming an organic low k dielectric layer over an  
4 insulation layer over a substrate;
- 5 b) forming a masking pattern over said organic low k  
6 dielectric layer; said masking pattern having an  
7 opening;

8 c) using an etch process said organic low k dielectric  
9 layer through said opening using said masking pattern as  
10 an etch mask; said etch process comprising:

11 (1) in a first step, etching said organic low k  
12 dielectric layer by applying a plasma power and  
13 flowing  $\text{NH}_3$  and  $\text{H}_2$  etch gasses.  
14

1 12. The method of claim 11 wherein said first step comprises:  
2 a plasma power between 500 and 1500 W, medium plasma  
3 power plasma density between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$ , a  $\text{NH}_3$  flow  
4 between 50 and 300 sccm, a  $\text{H}_2$  flow between 50 and 300 sccm and a  
5 pressure between 80 and 800 mTorr.

6 13. The method of claim 11 wherein said first step comprises:  
7 a plasma power between 500 and 1500 W, medium plasma  
8 power plasma density between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$ , a  $\text{NH}_3$  flow  
9 between 50 and 300 sccm, a  $\text{H}_2$  flow between 50 and 300 sccm and a  
10 pressure between 80 and 800 mTorr and flowing  $\text{O}_2$  or CO gasses.

11  
12 14. The method of claim 1 wherein said organic low k dielectric  
13 is comprised of a material selected from the group consisting  
14 of fluorinated arylether, Benzocyclobuthene (BCB), amorphous  
15 teflon, carbon doped oxides, poly arylene ether (PAE) and  
16 organic Spin on materials.

17 15. The method of claim 11 wherein said organic low k  
18 dielectric is comprised of a material selected from the group  
19 consisting of fluorinated arylether, and poly arylene ether.

20 16. The method of claim 11 wherein said organic low k  
21 dielectric is comprised of carbon doped oxide.

22 17. The method of claim 11 wherein said organic low k  
23 dielectric is comprised of poly arylene ether (PAE).

24 18. The method of claim 11 wherein said etch forms a first  
25 opening through said organic low k dielectric layer; said  
26 first opening having sidewalls defined by said organic low k  
27 dielectric layer; said sidewalls are substantially vertical at  
28 a angle between 87 and 93 degrees to the surface of the  
29 substrate.

1 19. A method of fabrication of etching a low -k dielectric  
2 layer; comprising the steps of:

- 3 a) forming an organic low k dielectric layer over a  
4 insulation layer over a substrate;  
5 b) forming a masking pattern over said organic low k  
6 dielectric layer; said masking pattern having an  
7 opening;  
8 c) using an etch process said organic low k dielectric  
9 layer through said opening using said masking pattern as  
10 an etch mask; said etch process comprising:

- 11 (1) in a first step, etching said organic low k  
12 dielectric layer by applying a plasma power and  
13 flowing only  $\text{NH}_3$  and  $\text{N}_2$  etch gasses.  
14

20. The method of claim 19 wherein said first step comprises:  
power in between 500 and 1500 W, medium plasma power  
plasma density between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$ , a  $\text{NH}_3$  flow between 50  
and 300 sccm and a  $\text{N}_2$  flow between 50 and 300 sccm and a  
pressure between 80 and 800 mTorr.

21. The method of claim 19 wherein said first step comprises:  
power in between 500 and 1500 W, medium plasma power  
plasma density between  $1\text{E}9$  and  $1\text{E}11 \text{ cm}^{-3}$ , a  $\text{NH}_3$  flow between 50  
and 300 sccm and a  $\text{N}_2$  flow between 50 and 300 sccm and a  
pressure between 80 and 800 mTorr and flowing CO or  $\text{O}_2$  gasses.

22. The method of claim 19 wherein said organic low k dielectric is comprised of a material selected from the group consisting of fluorinated arylether, Benzocyclobuthene (BCB), amorphous teflon, carbon doped oxides, poly arylene ether (PAE) and organic Spin on materials.
23. The method of claim 19 wherein said organic low k dielectric is comprised of a material selected from the group consisting of fluorinated arylether, and poly arylene ether.
24. The method of claim 19 wherein said organic low k dielectric is comprised of carbon doped oxide.
25. The method of claim 19 wherein said organic low k dielectric is comprised of poly arylene ether (PAE).
26. The method of claim 19 wherein said etch forms an first opening through said organic low k dielectric layer; said first opening having sidewalls defined by said organic low k dielectric layer; said sidewalls are substantially vertical at a angle between 87 and 93 degrees to the surface of the substrate.